The Athletic Health Care and Training Program

A Comprehensive Approach to the Prevention and Management of Athletic Injuries in High Schools

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The Athletic Health Care and Training Program was developed to meet the educational, organizational and record-keeping needs of the interscholastic athletic program of the Seattle Public Schools. The program components were the education of coaches, school nurses and student trainers; development of a centralized training room; implementation of written procedures, and establishment of a record-keeping system. At the end of the three-year study period, schools involved in the program were better prepared to handle emergencies than were control schools. Schools involved in the program were found to have an injury-recognition rate comparable to that previously reported for high schools that had athletic trainers, a rate substantially higher than that in the control schools. The experimental schools were judged to have managed these injuries satisfactorily 95% of the time, compared with a satisfactory management rate of 14% for the control schools.

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In a federal study reported in 1979,[1] it was estimated that nearly 600,000 injuries were sustained by 5 million male and female participants in high school interscholastic sports during the 1975-1976 school year. Approximately 15% of these injuries resulted in more than three weeks of time lost. While interscholastic sports have traditionally involved primarily male athletes, participation by women has grown steadily in the past decade. In 1975-1976 more than a million women played varsity sports and incurred 100,000 injuries.[1]

Several studies[2-6] have shown that high school coaches and student athletes are not adequately trained in basic principles of athletic health care, namely injury recognition, treatment, rehabilitation and prevention. Calvert[1] reported that 77% of high schools identified a coach as the source of athletic health care; however, only 53% of these coaches have had adequate training for these responsibilities. Moreover, 11% of public high schools and 15% of private secondary schools have athletic trainers on their staffs, but only 5% of athletic trainers are certified by the National Athletic Trainers Association (NATA).[1]

At the high school level, there has been no system of recommended procedures or guidelines for the students, parents and coaches who must initially cope with most sports-related injuries.[3-5,7] In a Nebraska study in 1981, Conley[8] noted that 70% of high schools surveyed did not even have an emergency transportation policy. Moreover, there has been little effective communication and coordination among those responsible for maintaining an athlete's health. It is not surprising that even when proper decisions are made by an athlete's personal doctor regarding injury management, the instructions are often carried out incorrectly or not at all. This lack of communication and inadequate attention to detail were noted in the Nebraska study, which indicated that 75% of schools do not have a follow-up care policy in force.[8] Another significant shortcoming of high school athletic programs has been the failure to maintain meaningful records that can be used to follow an injured athlete's progress and ensure that the athlete returns to play only when it is safe to do so.

Both the lack of basic health care information and the absence of a systematic administrative approach are central to the problems experienced by high schools in preventing and managing injuries. Others have recognized these deficiencies

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ABBREVIATIONS USED IN TEXT

DOE = Department of Education
NATA = National Athletic Trainers Association

and have created models for understanding the steps required to formulate a program for preventing and managing injuries.[9,10] While the educational needs have begun to be addressed, few of the organizational and managerial needs have been implemented at the secondary school level.

The Athletic Health Care and Training Program was developed as a model pilot program at the Division of Sports Medicine, University of Washington, to provide a comprehensive health care program to meet the educational, organizational and record-keeping needs of the interscholastic athletic program of the Seattle Public Schools.[11] The program was funded under Title IV-C, Elementary/Secondary Education Act, US Department of Education (DOE). The program was validated by the Joint Dissemination Review Panel of the DOE on July 21, 1982. The program has been part of the National Diffusion Network since November 1983. In this paper, we report the methods used in implementing the program and the data obtained during the evaluation of it.

Methods

Components

The interventions of the program were (1) to create a "health care team" by educating coaches, student athletic trainers and school nurses; (2) to develop a centralized training room operated by student trainers under adult supervision; (3) to implement a series of written guidelines, protocols and procedures for daily use by the health care team in preventing and managing injuries for athletes in all sports, and (4) to use record-keeping forms that facilitate sharing information with parents, personal physicians and other members of the health care team.

Population

In all, 16 high schools (12 public and 4 private or parochial) composed the Seattle Metropolitan League. None of the 16 schools had a functioning centralized training room, an educational training program for coaches, a system of athletic record keeping, properly outfitted first-aid kits or appropriate sideline emergency equipment. Seven schools were initially selected in 1978 by the athletic coordinator of the Seattle Public Schools for participation in the program. Five schools completed implementation of the program. A lack of administrative commitment on the part of two schools was the principal reason for failure of implementation. Each of these five experimental schools participated in parts of the evaluation. Four schools were selected as controls for various parts of the evaluation from among the nine schools that were not chosen for participation in the program. A comparison of the five experimental schools and the four control schools showed that the two groups were similar with regard to enrollment, faculty size, athletic participation and the composition of the coaching staff.

Evaluation

To evaluate the effects of the various program interventions, specific objectives reflecting outcomes were developed. Several instruments to measure these outcomes were created specifically for this purpose.

The specific objectives of the program were as follows:

- *Training.* The coaches, student trainers and school nurses who complete the 27 classroom-hour training course would have increased knowledge of athletic health care principles and practices based on pretest and posttest results.
- *Emergency preparedness and pre-event protocols.* Experimental schools would have emergency preparedness and use pre-event procedures to a greater extent than would control schools.
- *Injury recognition.* Experimental school coaches would have a greater ability to recognize injuries than control school coaches.
- *Postinjury protocols.* Experimental schools would more closely follow appropriate postinjury procedures than would control schools.

Financial limitation of the grant necessitated that only some of the schools could be evaluated for each objective. All five experimental schools and all four control schools were involved in at least one part of the evaluation.

Measurement of Educational Outcome

The training course for coaches, school nurses and student trainers consisted of 27 hours of lectures, slide presentations, demonstrations, videotapes and laboratories. A 300-page text was prepared to augment the classroom teaching. The course covered four areas: (1) "prehabilitation"—those preventive measures carried out before the first competition, such as screening, conditioning, nutrition guidelines, equipment fitting, safety measures and emergency preparedness; (2) injury management, including recognition, first-aid treatment, referral to a personal doctor, rehabilitation and definition of criteria for return to play; (3) athletic trainer skills—laboratory sessions covering taping, wrapping, use of heat and ice and equipment modification, and (4) health system organization, including record keeping, communications and standardization of written guidelines and protocols.

A 72-item multiple-choice cognitive test was used as a pretest and a posttest for all coaches, school nurses and student trainers to evaluate the educational gains from the training course. A KR-20 reliability coefficient of internal consistency was determined for the examination. The validity of each question was confirmed by three faculty members from the Division of Sports Medicine. To measure whether pretesting had an effect on posttest outcome, one class of coaches and one class of student trainers took the course without a pretest. A t test for related means was applied to determine the statistical significance of the pretest to posttest differences within each group. A t test for unrelated means was applied to compare the test results of coaches, school nurses and student trainers.

Measurement of Behavioral Changes

- *Emergency preparedness and sideline safety activities.* The availability and adequacy of first-aid kit contents, sideline supplies, sideline emergency equipment, preevent warm-up activities and sideline safety activities were monitored and recorded by two trained observers. These on-site observations were made at least once for all sports at three experimental schools and at three control schools during the 1979-1980 school year. During each observation the pres-

ence or absence of 51 items or activities was assessed. Each item of the first-aid kit and each component of the sideline supplies and emergency equipment were given a weighted value from 1 to 5, depending on their importance to emergency preparedness or injury prevention (Table 1). The scores for the first-aid kit items (20 items) were added separately from the scores for the components of the emergency equipment and sideline supplies (ten items). The nonparametric Wilcoxon test, which uses comparisons of the sum of ranks, was applied to both data sets.

Each of the pre-event warm-up activities and sideline safety activities was analyzed separately by a χ^2 test.

• *Injury recognition.* All experimental and control schools were required to complete and submit a monthly injury report form for each sport during the 1980-1981 school year. All 16 schools in the Seattle Metropolitan League had been voluntarily using this monthly injury report form for each sport during the 1979-1980 school year. All coaches received an annual in-service session on proper use of the form during the preseason meetings of coaches. Comparison of the 1979-1980 record keeping from experimental and control schools showed similar compliance in the proper use of the form.

An injury was defined as a medical problem resulting from athletic participation that required an athlete be removed from a practice or competitive event or miss a subsequent practice or competitive event. A day lost to injury was any day in which the athlete was not able or not permitted to participate in an unrestricted manner. Time lost to injury was expressed as the number of practices and games (rather than calendar days) the athlete missed or participated in on a limited basis. Significant injuries were defined as those that limited participation for five or more practices and games, major injuries as those that limited participation for 15 or more practices and games.

Injury rates were expressed as injuries per 100 athletes per season and as injuries per 1,000 athletic exposures. An athletic exposure was defined as any practice or game in which an athlete had an opportunity to be injured. The total team athletic exposures for a season were obtained by adding the number of athletes participating each day.

Data from the 1980 football injury reports from three experimental schools and two control schools were analyzed by a χ^2 test and a test of significance between two independent proportions.

• *Injury management.* A case study technique was developed to evaluate sports injury management. A comprehensive interview format was used to provide information on an injured athlete. Football injuries were studied at the same five high schools that provided the injury recognition data. All athletes who missed a game or practice during October 1980 and were at school on the day when the data collector visited were interviewed. Interviews were conducted retrospectively after the football season. In all, 38 cases from three experimental schools and 21 from two control schools were examined. Data were collected on each injury from the time of occurrences through all phases of treatment, rehabilitation and return to play. A graduate student in health education was trained to collect the data through structured interviews with the injured athlete, the football coach and student trainers.

Objective criteria for evaluating injury management were developed in conjunction with certified athletic trainers. A ten-page explanation detailing these criteria was provided to each evaluator, along with a scorecard for grading each case (Figure 1).

Four time periods were considered: the period immediately after recognition of the injury (day 1); a later time on the same day in the training room or locker room (day 1); the time period between the day of injury recognition and the day of return to play (day 2 through day X), and the day of return to play (day X plus 1). Within each time period, four activities were evaluated: examination and assessment; first aid, ongoing treatments and rehabilitation; communication with parents and personal doctors, and record keeping. In addition, initial injury recognition and transport to the sideline and locker room were studied.

The data from each interview were summarized in narrative form. The case study narratives were evaluated by 11 physicians and 2 university athletic trainer-therapists who were unaware of which high school an injured player attended. An overall score of pass or fail was affixed to each case by the 13 evaluators based on specific judgments regarding health care performance for each activity within the various time periods. A test of significance between two independent proportions was applied to the data from experimental schools and control schools.

TABLE 1.—*Sideline Observation Check Lists and Point Values*

First-Aid Kit Items

Category/Item	*Point Value*
Emergency	
Athlete identification cards	4
Directions to hospital	3
Coins for telephone	3
Oral airway	3
Flashlight	2
Taping	
Adhesive tape	4
Underwrap	3
Scissors/tape cutters	3
First aid	
Band-Aids	3
Gauze pads	3
Elastic wraps (Ace)	3
Skin lubricant	3
Ointment	2
Alcohol	2
Eyewash	1
Miscellaneous	
Cotton balls	1
Cotton-tip applicators	1
Finger splint	1
Tissues	1
Tongue blades	1

Emergency Equipment/Sideline Supply Components

Water	5
Ice in plastic bags	3
Ice chest	2
Crutches	3
Sling	3
Air splints	2
Stretcher	2
Towels	1
Knife/Phillips screwdriver (football only)	3
Bolt cutters (football only)	3

Results

Educational Outcome

The reliability coefficients for four separate classes showed a pretest range of 0.71 to 0.78 and a posttest range from 0.86 to 0.96. These results indicate a high level of test reliability.

The pretest and posttest results for participants in the training courses are shown in Table 2. The 169 coaches, 24 school nurses and 130 student trainers all showed statistically significant increases in cognitive gains ($P < .001$). The improvement was approximately twice the standard deviation for each group.

The 23 coaches and 50 student trainers who took courses without a pretest had posttest means, standard deviations and ranges that were not significantly different ($P > .05$) from the posttest means of those who took the pretest (Table 2). These data indicate that taking a pretest did not influence the outcome of the posttest.

In all, 14 student trainers attended the course a second time one year later and retook the pretest and posttest (Table 3). The posttest mean score for these student trainers after taking the course a second time was not significantly different from the posttest mean scores of either the coaches or the school nurses. The knowledge loss over the year from the first posttest to the second pretest (2.75%) was not statistically significant. Student trainers showed significant gains in knowledge each time the course was taken ($P < .001$). The percentage gain for these student trainers from the first pretest to the second posttest was 28.54%.

Behavioral Changes

• *Sideline observations.* The results from the on-site observations for all sports from three experimental and three control schools showed that the experimental schools were better prepared than the control schools (Table 4). The scores that reflected the contents of the first-aid kits from the two groups of schools were significantly different ($P < .005$) based on a 20-item list (Tables 1 and 4). Similarly, the two groups of schools differed significantly ($P < .01$) in the availability of other sideline supplies and emergency equipment based on a ten-item list (Tables 1 and 4).

Sideline observations monitoring preevent activities and safety precautions during practices and games were also made. A χ^2 test used to compare the data from the experimental and control schools showed that the experimental schools did significantly better ($P < .01$) than control schools with regard to each of the following items: preventive taping, the use of proper technique for static stretching before activity, stretching as a team activity rather than as an individual activity, the presence of ice in plastic bags in an ice chest at

TABLE 2.—*Test Results of the Educational Courses for Coaches, School Nurses and Student Trainers*

		Pretest			Posttest			Difference		
Group	Number	$\bar{X}$(%)	SD	Range	$\bar{X}$(%)	SD	Range	Mean Gain (%)	SD	Significance (P Value)
Coaches	169	55.06	9.02	33-76	72.59	9.44	44-94	17.53	8.19	<.001
	23*	. . .	. . .	. . .	74.00	8.70	50-90	. . .		
School nurses	24	60.08	7.16	45-75	75.75	9.32	50-93	15.67	8.84	<.001
Student trainers	130	42.38	8.67	14-63	64.64	10.47	28-91	22.26	8.52	<.001
	50*	. . .	. . .	. . .	63.75	11.86	28-84	. . .		

$\bar{X}$ = mean; SD = standard deviation.

*Did not take pretest.

CASE STUDY SCORECARD CASE # _____ EXAMINER _____

	IMMEDIATE CRISIS Field + Sideline or Time First Reported	SAME DAY: POST CRISIS Locker/Training Room after Game or Practice	TREATMENT-REHABILITATION From First Day After the Injury until the Day of Return to Play	RETURN TO PLAY Decision and Actions about Participation	TOTAL
Injury Recognition					
Transport	To sideline	To training room			
Examination-Assessment (History, Physical exam and diagnosis)	Initial exam	Re-examination inside	Progress assessments	Clearance exam	
First Aid + Treatments	At sidelines	Inside training room Also - to go home	Protocols + Modalities	To permit safe play Equipment Adjustment Taping	
Communication-Advice	Parents/Doctor Actions at home	Parents/Doctor Actions at home	Doctor visit; Coach contact with doctor	Doctor's clearance Coach contact to doctor	
Record Keeping	Daily Injury Report Note to Doctor/Parent	Daily Injury Report Note to Doctor/Parent	Doctor's note Forms-Treatments, Team Doctor, Injury Report	Doctor's clearance note; Daily Injury Report	
TOTALS					

Figure 1.—Case Study Scorecard.

TABLE 3.—*Test Results of Student Trainers Who Completed Educational Course Twice*

Group	Number	Pretest $\bar{X}$(%)	Pretest SD	Pretest Range	Posttest $\bar{X}$(%)	Posttest SD	Posttest Range	Difference Mean Gain (%)	Difference SD	Significance (P Value)
First course	14	45.82	6.24	35-57	65.89	10.29	51-85	20.07	9.67	<.001
Repeat course	14	63.14	9.50	50-81	74.35	9.50	60-85	11.21	7.50	<.001

$\bar{X}$ = mean; SD = standard deviation

TABLE 4.—*All Sports Sideline Observations for Presence of Emergency Items*

	First-Aid Kit Score		Sideline Supplies/ Emergency Equipment	
	Experimental	Control	Experimental	Control
Number of schools	3	3	3	3
Number of observations	115	73	115	73
Sum of ranks	12,121	5,645	11,792	5,974
Mann-Whitney U statistic	2,944		5,122	
Z score	3.45		12.55	
Significance level	$P<.005$		$P<.01$	

the sidelines and the presence of student trainers before and during activity.

• *Injury recognition.* The injury report data from the 1980 football season are shown in Table 5. The reported frequency of injuries at the experimental schools was significantly higher than that at the control schools ($P<.001$). When expressed as injuries per 100 participants per seasons, the experimental schools reported nearly three times more injuries than control schools. When the rates were normalized to injuries per 1,000 athletic exposures, the rate was 2½ times greater at the experimental schools ($P<.001$).

The anatomic locations of the football injuries were generally similar between experimental and control schools, with 53% of experimental (E) and 45% of control (C) injuries to the lower extremity, 14% of E and 15% of C to the hip and torso, 28% of E and 24% of C to the upper extremity and 4% of E and 15% of C to the neck and head.

The severity of injuries differed for the experimental and control schools (Table 5). The median time loss for each injury was three practices and games for experimental schools and five practices and games for control schools. The percentage of total injuries classified as significant and major injuries was significantly higher ($P<.01$) for the control schools than for the experimental schools.

• *Injury management.* The case studies were collected from the same three experimental and two control schools that were used to provide the injury recognition data (Table 5). The sample size was 22% of all the football injuries from the experimental schools for the 1980 football season and 57% of the football injuries from the control schools. The results showed that 36 of 38 cases (95%) from experimental schools received a majority of passing grades for injury management, whereas only three of 21 cases (14.3%) from control schools received a majority of passing grades from the 13 reviewers (Z statistic = 6.25; $P<.001$). In 50 of the 59 cases (85%), the agreement on pass-fail results was 10 to 3 or more. Evaluation was unanimous (13 to 0) in 25 cases. When minor injuries (one day only) and major injuries (15 or more games and practices) were removed from the case study analysis, a majority of passing grades was shown in 2 of 17 (12%) cases from control schools and in 20 of 22 (91%) cases from experimental schools ($P<.001$).

The control schools did progressively worse than experimental schools in all aspects of injury management as the time after injury increased. First aid, communications and record keeping were the activities in which these deficiencies were most pronounced. Record keeping was the activity in which the difference between the experimental and control schools was the greatest, followed by communication and first-aid management. Experimental schools more frequently followed procedures that the evaluators deemed desirable athletic health care than did control schools.

Discussion

The study showed that it was possible to implement a comprehensive and systematic program of athletic health care in high schools. An important measure of success was the behavioral changes that took place following training. The application of knowledge in emergency preparedness and in warm-up and sideline safety activities was more important than the mere acquisition of such knowledge. All sports were assessed in the sideline observation portion of the evaluation; hence, the significance of the difference between experimental and control schools indicated improvement in those areas for the entire athletic program, not just football.

Differences in injury rates arise in part from differences in the definition of an athletic injury. Because of our interest in examining injury recognition, we chose a definition that provided the highest sensitivity. Thus, our definition of an athletic injury was that used by Garrick and Requa,[12] which included all injuries resulting in any restriction in participation, including those injuries resulting in restricted participation only on the day of the injury.

Differences in injury rates also occur as a result of the method of reporting injuries. Two studies of high school football injuries in North Carolina, which used different methods of coach reporting, identified rates of about 40 to 55 injuries per 100 participants per season.[13,14] The Seattle study of Garrick and Requa,[12] conducted during the mid-1970s, identified injuries by placing an NATA-certified athletic trainer in each of four high schools. The injury rate for football in the Seattle study was 81 injuries per 100 participants per season. In the present study the control schools had a football injury rate (26.9 per 100 participants per season) similar to most of the studies using the coach-reporting method. The experimental schools had an injury rate (79.8 per 100 participants per season) similar to the rate reported when athletic trainers were present in the schools.

It seems unlikely that the implementation of an educational program and organized system of injury management resulted in a doubling of injuries. Rather, the difference was more likely related to a higher rate of injury recognition by experi-

TABLE 5.—*Football Injuries Reported by Coaches for 1980**

	Experimental	*Control*	*Significance (P Value)*
Number of schools	3	2	....
Average squad size	71	69	....
Injury rate/100 athletes/season	79.8	26.8	....
Injury rate/1,000 athletic exposures	17.3	6.9	<.001
Median time loss/injury (games and practices)	3.0	5.0	....
Mean time loss/injury (games and practices)	5.1	9.2	<.001
Significant injuries/total injuries (%)	29.0	54.0	<.001
Significant injuries/100 athletes/season	23.5	14.5	....
Significant injuries/1,000 athletic exposures	5.1	3.7	<.01
Major injuries/total injuries (%)	8.0	24.0	<.01
Major injuries/100 athletes/season	6.1	6.5	....
Major injuries/1,000 athletic exposures	1.3	1.7	NS

NS=not significant

*Significant injury = time loss of 5 or more games and practices; major injury = time loss of 15 or more games and practices.

mental schools. More than half (54%) of the injuries at control schools resulted in a time loss of five or more practices and games compared with 29% at experimental schools ($P<.001$). By comparison, in the Seattle study[12] in which certified athletic trainers reported injuries, 31% of football injuries resulted in more than five days of time lost. The experimental schools' shorter average time loss may reflect both recognition of minor injuries and better management of moderate injuries, two factors that can be expected to decrease time loss.

Record keeping has rarely been considered an important part of high school athletic health care, while certified trainers at the university and professional level routinely maintain such records. As Conley reported in the Nebraska survey,[8] less than 25% of high schools have a follow-up care policy *in force*. Examples of such a policy include establishing guidelines for referral to a physician, requiring a written note from the physician specifying the diagnosis and treatment plan, ensuring that arrangements for rehabilitation of an injury are made and requiring written clearance from a physician before the athlete is permitted to return to participation. Attention to detail through record keeping, as shown in the case studies, helped to ensure that the guidelines and procedures that are intended for implementation were in fact being carried out.

Perhaps the simplest and most direct way to manage athletic health problems in high schools would be to place an NATA-certified trainer in each high school.[6,7,15,16] This solution is not currently practical because there are 20,000 secondary schools and fewer than 5,000 certified trainers. The presence of a certified trainer does not in itself answer all of the athletic health care needs of high schools, because the trainer cannot always be present where athletes are participating. There still would be a need for educated coaches and student trainers who *are* present at all practices and games. Coaches are directly responsible for all aspects of their interscholastic athletic teams, including the management of the athletic health care.

The keys to successfully instituting an adequate health care system for high school athletics are the recognition that a problem exists and an administrative commitment to make the needed changes on a schoolwide basis. Reliance on a voluntary change in behavior by individual coaches after participation in an educational program is fraught with uncertainty. Calvert[1] noted that the attention of coaches generally focuses on the practice or competition itself, rather than on health care problems. An organized approach that offers a coach some assistance from other trained persons (student trainers, school nurses, adult trainers) in meeting these responsibilities would be more likely to yield satisfactory outcomes in preventing and managing injuries.

This study has shown that a comprehensive and systematic program of athletic health care for high schools can be implemented and evaluated. Institution of the Athletic Health Care and Training Program in Seattle area high schools resulted in significant educational gains; favorable behavior modifications relating to preparedness for emergencies and injury; recognition of injury and management of injuries, and improved cooperation, communication and record keeping. This program is available for dissemination to high schools throughout the nation via the National Diffusion Network of the US Department of Education.

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